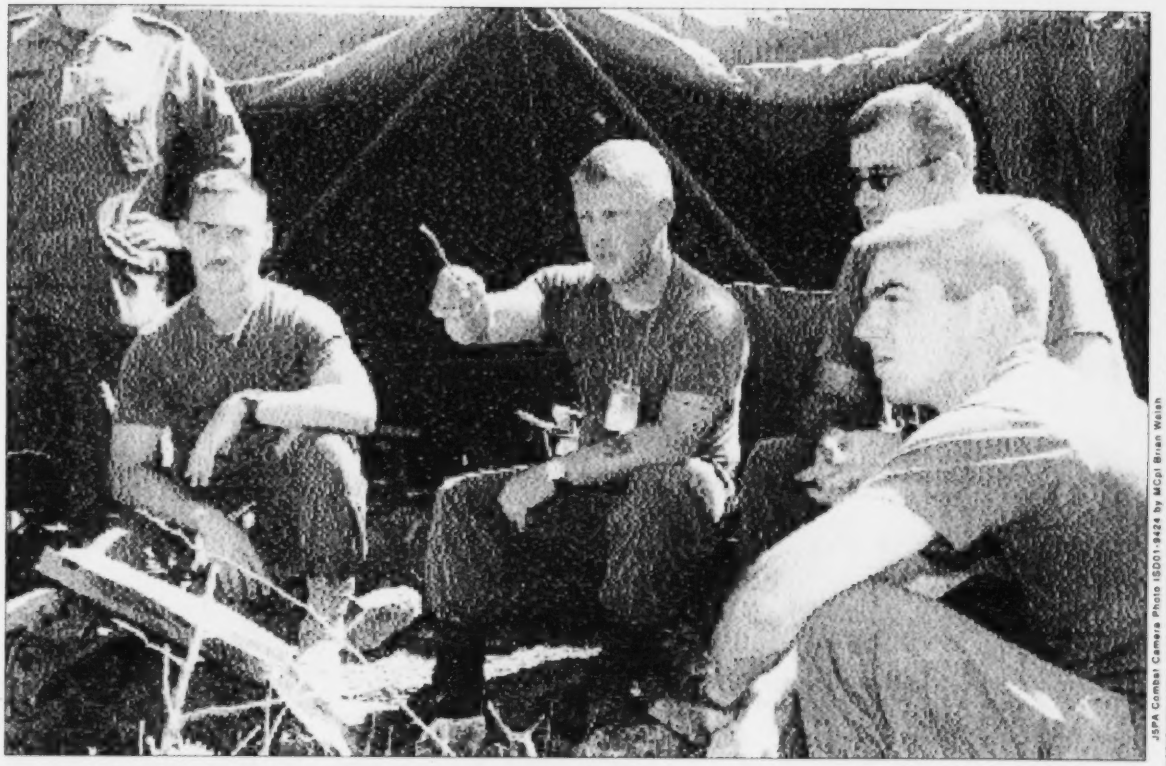

JSPA Combat Camera Photo ISD01-9424 by MCpl Brian Welsh

Soldiers of 'A' Squadron, The Royal Canadian Dragoons, get a briefing from their patrol commander at an observation post in Macedonia, September 2001.

RE-CONCEPTUALIZING COMMAND AND CONTROL

by Dr. Ross Pigeau and Carol McCann

It seems ironic that an organization like the military can contribute to a language's lexicon, and yet not use this lexicon consistently in its own day-to-day activities. The terms 'command', 'control', and 'command & control' (i.e., C^2) are a case in point. These terms are recognizably military, and are well-entrenched in the military's doctrinal and operational vocabulary.[1] Yet the manner in which these terms are used, as well as the circumstances of their usage, varies with confusing complexity. For example, some branches of the military endorse the concept of mission command, others endorse a philosophy of centralized control and decentralized execution, while in other services the notion of network-centric C^2 is prominent.[2] NATO employs a dizzying array of C^2 nomenclature and authorities: OPCON, TACOM, full command, etc.[3] And if we look for help from official definitions of Command, Control and C^2 (e.g., those of NATO), we find that the definitions themselves are circular and redundant. The command definition makes use of the word control, the control definition uses concepts that are part of the definition of command, and the definition of C^2 is merely a longer restatement of the definition of control.[4] Add to this confusion the growing and bewildering array of C^2 acronyms adopted by militaries around the world (e.g., C^2I, C^3I^2, C^4ISRW, etc.), and it is no wonder that defence analyst Greg Foster has described the state of Command and Control theory as bleak, using words like "inchoate", "diffuse", "conjectural" and "seemingly random".[5] In our opinion, Foster's description continues to reflect the state of Command, Control and C^2 today, both in Canada and internationally.

Our interest in command and control began in 1993 when we were asked to establish a C^2 research program at the Defence and Civil Institute of Environmental Medicine. Being motivated scientists, we immersed ourselves in books and journal articles about C^2. We then consulted with research colleagues, both nationally and internationally, and proceeded to interview commanders from all services. We attended military conferences,[6] participated in meetings at a number of DND directorates that were involved in the development of C^2 systems. At the end of a year of intense study, we realized that Foster's assessment was correct. There was little consensus within either the military or the research communities on the actual definitions for Command, Control and C^2.

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Exasperated but undaunted, we decided to start from scratch and re-conceptualize the whole area. Our intention was to develop an internally consistent set of command and control concepts that would form the framework for a uniquely Canadian research program. In the ensuing years, we have exposed our concepts to military and scientific scrutiny[7] and, more recently, have begun collecting data to validate our work. This paper describes our re-conceptualization of command and control and suggests ways in which it can be applied.

Our position is based on the following fundamental assumption: only humans command. Only humans demonstrate the range of innovative and flexible thinking necessary to solve complicated and unexpected operational problems. Only humans accept the responsibility commensurate with military success or failure. Only humans possess the dedication, drive and motivation to raise merely satisfactory military performance to outstanding levels. As self-evident as this assumption seems (i.e., that only humans command), it is amazing how little effort has been expended in deducing the organizational, psychological and technological implications it entails.

JSPA Combat Camera Photo IS01-98084 by MCpl Brian Walsh

The captain of HMCS *Preserver* is briefed on damage control during training conducted en route to the Arabian Sea for Operation "Apollo", October 2001.

In order to elucidate the nature of command, it is perhaps instructive to begin by describing what command is *not*. Thus, we will first explore the nature of control — the companion concept to command. As we will see, control provides the means and context for command. It is the indispensable mechanism for command expression.

WHAT IS CONTROL?

We must be careful to distinguish military control from engineering or cybernetic control. In our view, the latter is a subset of the former. Control in the cybernetic sense involves a feedback mechanism by which some outcome is compared to some goal: action is then taken that minimizes the difference between the two.[8] Cybernetic control systems ranging from the very simple (e.g., common household thermostats) to the very complex (e.g., nuclear power stations) have been developed successfully, many by the military. However, control in militaristic terms implies more than simply feedback mechanisms. It implies the personnel, facilities and procedures for planning, directing and co-ordinating resources in the accomplishment of the mission.[9] It implies standard operating procedures (SOPs), rules of engagement (ROEs), regulations, military law, organizational structures, policies, equipment — in short, all those structures and processes (including cybernetic processes) put in place by the military to facilitate the accomplishment of its mission in a safe and efficient manner. The notions of structure and process are key to understanding military control, and it is worth spending time elaborating them.

Structures are frameworks of interrelated concepts (or physical objects) that define and classify some larger entity. For example, a bridge is a physical structure of interrelated objects (e.g., girders, cables, trusses, etc.) that classifies an entity for spanning spaces. An organization is a structure of interrelated departments (e.g., personnel, administration, production, etc.) that classifies an entity for providing some product or service. In a universe where there may exist an infinite number of ways of spanning spaces or providing products, the use of the structure "bridge" or "organization" immediately reduces the space for describing the problem to a smaller, more manageable size and, by doing so, offers a more restricted set of solutions. Similarly, military control encompasses a host of structures for bounding the mission space — e.g., order of battle, data bases for describing terrain, sensor and weapon systems, etc.

Structure reduces uncertainty by bounding the problem space and increasing order (or meaningfulness).[10] Order then offers a rational basis for choosing and optimizing appropriate courses of action. Control processes, therefore, are sets of regulated procedures that allow control structures to perform work.[11] They are mechanisms for invoking and controlling (in the cybernetic sense) action. Military rules of engagement, for example, are formal processes for regulating the use of power— for specifying the way in which military structures (e.g., soldiers, battle groups, and squadrons) are allowed to achieve their objective.

Military plans are formal processes for conducting an operation. For example, the standardization of control processes by instituting SOPs is an efficient means for increasing the speed of response and reducing risk during exercises and operations.

Control structures and processes are essential for action. Structures provide a bounded problem space within which workable and efficient processes can then be applied to achieve solutions. We must caution, however, that control comes at a price: control, once adopted, restricts flexibility. Any particular structure and process (or any particular set of structures and processes) excludes from consideration an infinite set of alternative structures and processes that may suit the problem better. All control structures and processes, especially in organizations as large and as complex as militaries, have their strengths and their weaknesses, depending on the situation in which they are applied. The maxim 'Choose the right tool for the job' is intended to protect us from committing the error of another maxim: 'When all you have is a hammer, you tend to treat everything as a nail.' And as we will argue, overcoming control restrictions on flexibility is one of the critical functions of command.

WHAT IS COMMAND?

It may appear from our discussion of control that everything of military value is implicated in our notions of structure and process. After all, if control includes organizational structures, SOPs, ROEs, military rules and regulations, sensor and weapon systems, equipment, doctrine, training programs, etc., then what is left that could possibly qualify as command? This question is particularly pertinent if we are implying that even the military chain-of-command is actually a control structure (which we are). The answer lies in two fundamentally important and uniquely human characteristics: creativity and will.

All control structures and processes are human inventions, either directly or indirectly. Weapons do not build themselves, doctrine does not write itself, plans do not change of their own accord and algorithms do not set their own initial conditions. An individual (or a group of individuals), somewhere, and at some point, invested time and effort to create the structures and processes that militaries now use. Structure and process are possible only because of human creativity[12] and human determination. Space does not permit an extended discussion of the science of creativity, but we must emphasize that creativity is not restricted to geniuses or to intellectuals.[13] Creativity is a common human ability that expresses itself throughout the range of human behaviour — from the study of military art and science, to negotiating passage through checkpoints while on operations, to planning alternative routes when driving home from work.

The invention of military structures and processes requires creativity, but the importance of creativity does not end there. Inevitably these structures and processes must be changed, adapted, altered, interpreted and, sometimes, even re-invented to suit the evolving needs of the military situation.[14] For example, much has been written about the 'fog' and 'friction' of war, the 'chaos' of battle and the complexity of peacekeeping operations. Common to all of these situations is the need for adaptability, the necessity of solving a multitude of unanticipated problems — both small and large — that together can impede mission objectives.[15] Solving these unanticipated problems requires creativity.

We assert that creativity is the most important requirement for command.[16] Without it, command is condemned to treating every new problem as an instance of an older one. We must stress, however, that although creativity is necessary for command, it is not sufficient. The will to be creative must also exist. Will involves the faculty of arriving at one's own decision, as well as the determination to act upon it, in spite of opposition. It is an attribute that has been pivotal in many descriptions and discussions of command.[17] Lieutenant General Raymond Crabbe considered will to be paramount in command, describing it this way:[18]

> If there was one characteristic of command that I believed must be ever present, it was the will to get the job done, to see an action through to its successful conclusion, to be resolute. The ability to overcome obstacles and impediments and get to the objective, to remain focused on the mission ... ensuring that impediments do not become showstoppers.

We define will as diligent purposefulness, and posit two conditions necessary for its expression. The first is motivation[19] and the second is opportunity. The importance of motivation for creativity can be illustrated by an example. Many businesses in Western society are highly 'proceduralized' — that is, the functions and services performed by their workers are regulated through the use of policies, guidelines, checklists, forms, regulations, algorithms, procedures, etc. The classic instance of proceduralization is the automotive assembly line with its extensive structures and processes (i.e., control) for manufacturing cars.[20] Yet as most unions know, an effective strategy for delaying or obstructing production is work-to-rule — that is, to work only within the explicit guidelines and duties stated for the position. Work-to-rule is effective as a job action because most businesses rely on the good *will* of their work force to creatively solve the many minor problems for which rules and regulations have not been (and may never be) developed. We stress that the potential for human creativity has not disappeared from the work force during a job action, only the motivation to express it.

The second condition for expressing will is opportunity. Opportunity is a favourable circumstance or condition for achieving objectives, and we will discuss it in the next section.

RE-DEFINING CONTROL AND COMMAND

Based on the discussion thus far, we offer the following new definitions of control and command. Notice that command is specifically mentioned in our definition of control, suggesting a manifest dependency.

- **control:** *those structures and processes used by command to enable it and to manage risk*
- **command:** *the creative expression of human will necessary to accomplish the mission*

The function of control is to enable the creative expression of will and to manage the mission problem in order to minimize the risk of not achieving a satisfactory solution. The function of command is to invent novel solutions to mission problems, to provide conditions for starting, changing and terminating control, and to be the source of diligent purposefulness. If command is incapable of fulfilling these functions — if it cannot, for example, identify new patterns of behaviour in the adversary or take advantage of changes in the environment — then the mission may fail.

There are important implications following from these new definitions of command and control. First, the definition of command embodies our assumption that "only humans command." Only humans possess the degree of diligent purposefulness necessary to accomplish mission objectives. Only humans possess the degree of creativity and inventiveness required to solve intractable problems. However, our assertion that "only humans command" should not be confused with the false assertion that "humans can only command." As our example of the job action demonstrates, humans are quite capable of not being creative. Instead, they can choose to function simply as extensions of an existing control system. But unlike the job action example, control behaviour in a military situation may be inappropriate. In many instances, following a procedure is the most appropriate course of action because it would be inefficient to re-invent solutions that already exist.

A second implication of our definitions is that they allow us to distinguish between the concepts of command vs. commanding and control vs. controlling — i.e., using the words as nouns vs. using them as verbs. Military usage is confusing in this matter, particularly concerning command. Often the act of commanding is equated with ordering — that is, commanding is viewed simply as an expression of authority. Although ordering does play a role in commanding, it is a subsidiary role. We will return to this matter after we have described command and control as actions.

Commanding is the act of creatively expressing will to accomplish the mission. Controlling is the act of enabling command and of managing risk using existing structures and processes. Table 1 lists the actions appropriate for each. Essentially, controlling involves monitoring, carrying out and adapting processes that have already been developed. Commanding involves creating new structures and processes (e.g., plans, SOPs, etc.), establishing the conditions for initiating and terminating action, and making unanticipated changes to plans. Most acts, including decision making, involve a sophisticated amalgam of both commanding and controlling. For example, firing a rifle requires the initial command act of deciding when to pull the trigger (e.g., "Is the conditions right? Is it safe? Am I ready to accept the responsibility of hitting or missing the target?"). Continued firing at the same target then involves the controlling acts of monitoring hits and missing and acting accordingly. However, if the person firing the weapon is instead told by another individual when explicitly to shoot and when explicitly to stop shooting, then the acts of commanding and controlling are divided between two people. The individual giving the instructions is commanding and the one firing is controlling.

But we must emphasize that simply ordering a person to carry out some action is not necessarily an act of command. If an order is transmitted without change or embellishment from a superior to a subordinate (e.g., if the platoon commander relays unchanged an order from the company commander to the section sergeant), no creativity is involved. Controlling, not commanding, is happening. Commanding occurs only if a person in the chain of command interprets an order and alters it to suit the vagaries of the situation before transmitting it further down.

Another reason that our concept of commanding implies more than simply the act of ordering is that it allows an individual, working alone, to command. The pilot in a single-seat fighter aircraft, or the soldier cut off from the group, can still creatively express his or her will to accomplish the mission — i.e., can still command — even though there is no one to order.

The third implication arising out of our new definitions is arguably the most important and controversial. Nowhere in our definition of command is it stipulated that only commanders command. Our definition explicitly states that human will and human creativity are sufficient. Any human, therefore, from the most junior military member to the most senior general officer, is capable of command because we assert all humans are inherently capable of creatively expressing their will to a greater or lesser extent, depending on talent, in the service of the mission. The

Commanding	Controlling
To create new structures and processes (when necessary)	To monitor structures and processes (once initiated)
To initiate and terminate control (this includes establishing the conditions for initiation and termination)	To carry out pre-established procedures
To modify control structures and processes when the situation demands it	To adjust procedures according to pre-established plans

Table 1: Command and Control as Actions

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Table 1: Command and Control as Actions

determining factors for whether will is expressed are motivation and opportunity. We have already mentioned the importance of motivation (recall the job action example). Militaries must insure that their personnel are properly motivated to achieve mission objectives by, for example, recruiting quality candidates, ensuring quality of life, espousing noble military values, offering challenge, etc.

However, motivation alone is insufficient for achieving objectives. The expression of command will also requires favourable circumstances and conditions — that is, opportunity. Simply wanting an outcome to occur, without the means and opportunity to make it happen, is not enough. Will requires both motivation and opportunity. Militaries need to ensure that their personnel have both the resources (or power) and the freedom to act creatively. They need to provide favourable conditions for command expression. For militaries to take advantage of the tremendous command potential resident in each of its members, they must encourage creativity and they must provide the opportunity for its expression. But these requirements lead to an interesting dilemma.

How do militaries assign resources and encourage freedom of action while at the same time ensuring the safe and coordinated use of these resources? Unbridled expression of command creativity can quickly lead to organizational chaos. Conversely, over-control can quickly lead to personnel de-motivation. Finding the correct balance is one of the premiere challenges facing modern military organizations, particularly when they must satisfy the competing demands of doctrine, technology, politics and tradition. How, then, do militaries encourage creative command on the one hand, yet control command creativity on the other? For example, the doctrine of mission command espouses the delegation of authority and the freedom to carry out actions consistent with the intent of the commander. Mission command, as a philosophy, attempts to maximize human creativity, initiative and diligence. New concepts like 'battlefield digitization' and the 'common operating picture', which arise from developments in computer and communication technologies, are designed to facilitate the expression of mission command by giving all members the same picture of the operation, thereby encouraging coordinated effort across all levels. But history has shown that technology also encourages over-controlling behaviour. An example is found in van Creveld's analysis of the war in Vietnam, which illustrates how helicopters and radios were used in micro-managing tactical operations:[24]

> A hapless company commander engaged in a firefight on the ground was subjected to direct observation by the battalion commander circling above, who was in turn supervised by the brigade commander circling a thousand or so feet higher up, who in his turn was monitored by the division commander in the next highest chopper...

The point is not to argue that micro-management is always wrong or that mission command is always right — that would trivialize the complexity of military operations. The point is to illustrate the difficulty in finding the correct balance between encouraging creative command and controlling command creativity.

Historically, a military's chain of command has been the principal ways both for providing and for constraining command opportunity. For example, during an operation, the position of commander is a military's primary mechanism for harnessing command potential, for giving it stability and fiduciary power, for formalizing its structure by situating it within a chain of command, and for maximizing the probability of its expression when it is operationally necessary to do so. The commander position is the traditional way that militaries provide and constrain opportunity for command expression. Although all individuals in a military can, in principle, exhibit command behaviour, the position of commander is where such behaviour, by decree, is encouraged and ultimately expected. Thus, the chain-of-command allows prescribed individuals the opportunity to creatively express their will by giving them the authority to do so.

Yet such opportunity comes at a price. Commanders must be held accountable for their creative actions. Creativity is expected and condoned only within the bounds of legal and moral guidelines. Indeed, some of these legal and moral guidelines are applicable to all military members — precisely because these individuals may find themselves in the position of having to creatively express their will to accomplish the mission (and hopefully do this in a manner consistent with the intent of the commander).

We do not wish to imply that rigid organizational hierarchies are the only mechanisms that militaries have for providing command opportunity, while at the same time controlling command expression. There are others, including military traditions, professional ethics, self-discipline, the military justice system, etc. Our point is that such control mechanisms are necessary, otherwise creative command may become unfocused, uncoordinated and possibly even dangerous. Equally necessary is the requirement to guard against over-controlling command, otherwise the very creative energy that control is meant to enable will be extinguished.

THE THREE DIMENSIONS OF COMMAND CAPABILITY

The implication that all military personnel, from the most junior to the most senior, are capable of command has far reaching impact, only part of which has been explored. How, for example, is command capability different for the various members of the military? What distinguishes the command capability of general officers from that of raw recruits? What factors contribute to command capability and how should these factors be weighted?

To address these issues, we propose a model called 'CAR' that incorporates the three factors of Competency, Authority and Responsibility. We will

first describe competency, authority and responsibility separately, and then we will explain how together they form the axes of an abstract three-dimensional space within which the command capability of all military members lies.

Competency

Military members need skills and abilities for accomplishing missions successfully. These abilities or competencies fall into the following four general classes: physical, intellectual, emotional and interpersonal.

For most militaries, physical competency is a prerequisite, one that is mandatory for any operational task, from conducting a ground reconnaissance, to loading a weapon and flying an aircraft. But physical competency is not limited to physical strength; it also involves sophisticated sensory motor skills, good health, agility and endurance. Although much technological development has been devoted to extending physical competency in humans (e.g., weapons, night-vision goggles, G-suits, etc.), militaries still place great importance on individual physical skills.

DSPA Combat Camera Photo ISD02-3016 by Sgt Gerry Pilote

3PPCLI officers conducting a reconnaissance of their area of responsibility at Kandahar airport in Afghanistan, February 2002.

The second skill set, intellectual competency, is critical for planning missions, monitoring the situation, using reasoning, making inferences, visualizing the problem space, assessing risks and making judgements. Even more important, since no two missions will ever be the same, intellectual competency must include creativity, flexibility and a willingness to learn.

The importance of physical and intellectual competency for command is well acknowledged. Most militaries establish physical and intellectual aptitude testing at recruitment. They follow this with extensive physical and intellectual development during basic training, and subsequently in specialist courses and at staff colleges. Indeed, militaries expend significant resources to ensure that their personnel have the requisite physical and intellectual competencies to accomplish their missions. Interestingly, much less effort is expended in developing the two other competencies — emotional and interpersonal — though they are equally important for command.

Missions can be ill-defined, operationally uncertain, resource-scarce and involve high risk to humans. Deployment in theatre is often very stressful for those deployed, as well as being disruptive to family life. Military members inevitably suffer a range of taxing negative emotions: guilt, anxiety, anger, frustration, boredom, grief, fear and depression.[25] Command under these conditions requires significant emotional competency, a competency strongly associated with resilience, hardiness and the ability to cope under stress.[26] Command demands a degree of emotional 'toughness' to accept the potentially dire consequences of operational decisions. The ability to keep an overall emotional balance and perspective on the situation is critical, as is the ability to maintain a sense of humour.

Finally, interpersonal competency is essential for interacting effectively with one's subordinates, peers, superiors, the media and other government organizations. Social skills, developed throughout childhood, are the basis for this competency, which develops to include attributes of trust, respect, perceptiveness and empathy that promote effective teamwork. Interpersonal interactions require an ability to articulate one's thoughts, ideas and vision — especially verbally, but also in writing.

The physical, intellectual, emotional and interpersonal are classes of competencies that play a significant part in delineating command capability.

Authority

Authority, the second capability necessary for command, refers to command's domain of influence. It is the degree to which a commander is empowered to act, the scope of this power and the resources available for enacting his or her will. We distinguish between the command authority that is assigned from external sources and that which an individual earns by virtue of personal credibility — that is, between legal authority and personal authority.

Legal authority is the power to act as assigned by a formal agency outside the military, typically a government.[27] Legal authority, as expressed explicitly in laws and regulations, formally assigns commanders resources and personnel for accomplishing the mission. It is noteworthy that the legal authority assigned to a nation's military goes well beyond that of any other private or government organization. Militaries have the authority to enforce obedience among their members and, more importantly, militaries can knowingly place these members in harm's way if the operational needs of the mission demand it. These unique powers, and the significant implications that derive from them, are key in distinguishing militaries from other large corporations.

Personal authority is that authority given informally to an individual by peers and subordinates. Unlike legal authority, which is made explicit through legal documentation, personal authority is held tacitly. It is earned over time based on reputation, experience and character, and is often acquired through personal example, as illustrated in the following quote from Gen. Matthew Ridgway:[28]

> I held to the old-fashioned idea that it helped the spirits of the men to see the Old Man up there, in the snow and sleet and the mud, sharing the same cold, miserable existence they had to endure.

The degree of personal authority achieved by an individual is correlated with professional knowledge and ability (i.e., competency). However, an individual's ethics, values, courage (both physical and moral) and integrity form the basis for a more enduring personal authority.

Although legal authority is an essential component of command for most militaries, in some organizations — for example guerrilla groups, para-militaries, cults — command authority is achieved almost exclusively through personal authority.[29] In these cases, command can be flexible, albeit perhaps arbitrary and idiosyncratic. By contrast, when an individual has been given the legal authority to command but has not been able to establish personal authority (by virtue of lack of time, opportunity, ability or inclination), command is relatively limited and rigid, because authority is based solely on formal mechanisms. Command authority is most effective with both legal authority to formalize power, and personal authority to motivate will in others.

Responsibility

The third dimension of command is responsibility. This dimension addresses the degree to which an individual accepts the legal and moral liability commensurate with command.[30] As with authority, there are two components to responsibility, one externally imposed, and the other internally generated. The first, called extrinsic responsibility, involves the obligation for public accountability.[31] For example, the assignment of legal authority is usually accompanied by a formal expectation by superiors that one will be held accountable for resources assigned. Since superiors (by definition) have greater legal authority than the individual being empowered, extrinsic responsibility implies (in this case) accountability up the chain of command. It implies a behavioural contract between the individual and his or her superiors. We must emphasize, however, that although legal authority implies accountability, extrinsic responsibility is not synonymous with accountability. Rather, extrinsic responsibility refers to a person's willingness to be held accountable for resources — that is, their willingness to take responsibility for the legal authority that comes with the position. So, although it is possible for superiors to explicitly delineate (e.g., to list in written form) subordinate accountabilities, until these accountabilities are accepted, extrinsic responsibility is not in place.

Extrinsic responsibility is also associated with personal authority. Personal authority is earned from superiors, peers and subordinates who, through implicit acts of trust and commitment, empower the individual with informal authority — an authority often associated with leadership. Personal authority comes with expectations, however. Subordinates and peers (the followers) expect that the individual (the leader) will behave in a manner consistent with their trust and not treat their loyalty frivolously. Personal authority, therefore, implies accountability down to those who are the source of the empowerment.

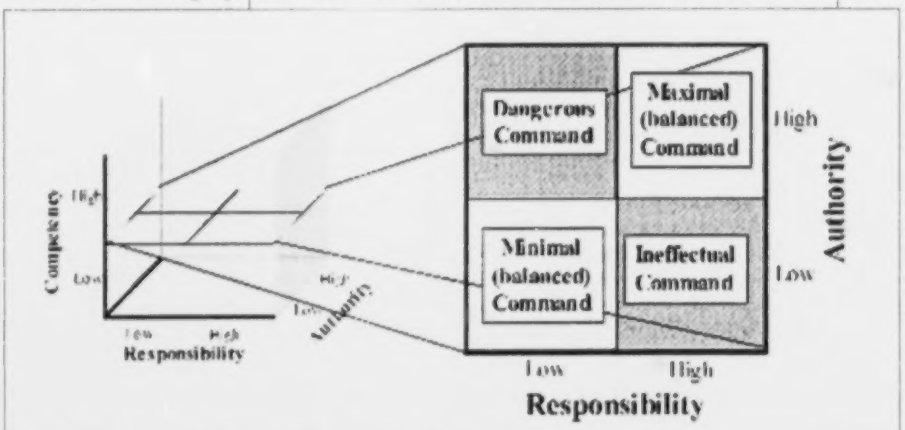

Figure 1 – The relationship between Authority and Responsibility in the CAR structure, when Competency is at a fixed level.

Extrinsic responsibility is the degree to which an individual feels accountable both up to superiors and down to followers. As such, it should be correlated with the amount of legal authority assigned and personal authority achieved, and it should act as a guarantee or

commitment on the part of the individual to dispense power responsibly. But history has shown that authority and extrinsic responsibility are not always correlated — sometimes there is an unwillingness to be held accountable for authority given. When this happens, the potential for abusing authority becomes great.

Intrinsic responsibility, the second component of responsibility, is the degree of self-generated obligation that one feels towards the military mission. It is a function of the resolve and motivation that an individual brings to a problem — the amount of ownership taken and the amount of commitment expressed. Intrinsic responsibility is associated with the concepts of honour, loyalty and duty, those timeless qualities linked to military ethos. Of all the components in the dimensions of command, intrinsic responsibility is the most fundamental. Without it, very little could be accomplished. It is the source of all motivation, effort and commitment. Indeed, it is the driving force behind the creativity that our definition asserts is essential for command. Intrinsic responsibility will be affected by such factors as whether military personnel are conscripted or allowed to volunteer, whether civilians support the role of military in society, and whether the military organization itself is perceived to be upholding the values deemed important by its own members.

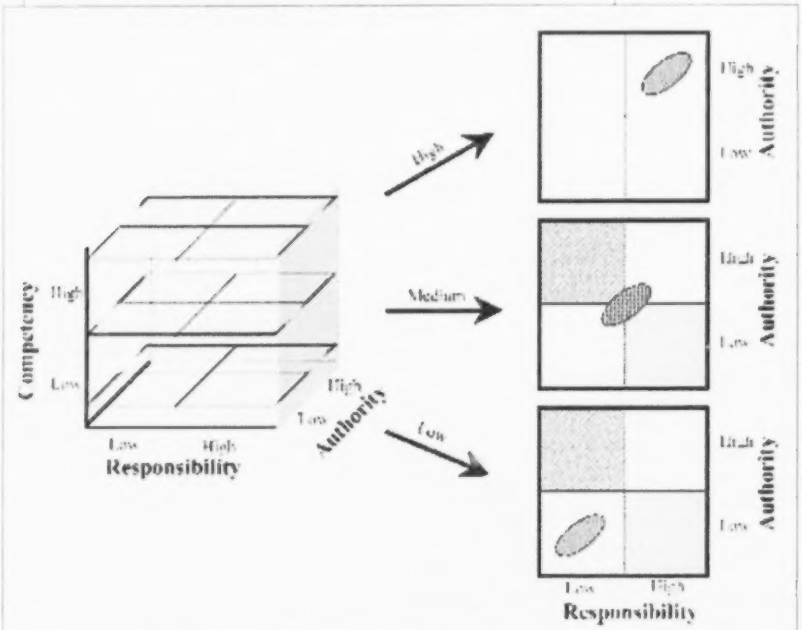

Figure 2 – Three slices of the Authority-Responsibility surface for three different levels of Competency.

THE COMMAND CAPABILITY SPACE

The CAR model allows us to map out the entire space of command capability as well as situate individual members within this space. As Figure 1 illustrates, each of the CAR dimensions describes one axis of an abstract 3-dimensional space. To better understand the implications of this space for command, first imagine a horizontal slice taken at some arbitrary level of competency (see Figure 1). This slice is a planar surface describing only the responsibility and authority dimensions (i.e., for the moment it ignores the competency dimension). For the discussion that follows, we have arbitrarily divided the surface into quadrants representing high and low values for each axis (see the right-hand side of Figure 1).

When there is high authority (both legal and personal) and acceptance of responsibility associated with this degree of authority (both extrinsic and intrinsic), the result is maximal (balanced) command. In this situation, the military organization can be assured that the authority assigned and earned will be treated responsibly in accordance with stated intentions, implied military values and general societal expectations. Balanced command is the desired state since responsibility is the only mechanism by which militaries can guarantee that their extreme power will be exercised safely and appropriately.

There are cases, however, when there is an acceptance of high levels of responsibility without commensurately high levels of authority being given. This condition results in ineffectual command: although responsibility has been taken, power over resources has not been assigned or no clear mandate to act has been authorized. The experience of a military commander like General Dallaire in Rwanda[32] provides an example of the frustration and perceived ineffectuality of command that can occur in peace support operations, despite the extremely high level of intrinsic responsibility that he brought to this mission. Ineffectual command undermines the very purpose of a military. Without authority, a commander is powerless to properly accomplish the mission, yet can feel responsible for not having done so. Without sufficient authority, a commander is compromised in his mission. Even worse, the individual in the position is placed under tremendous psychological pressure.

When little authority is assigned to or earned by an individual, and he or she has little expectation of being held accountable for actions, minimal (balanced) command results. The levels of authority and responsibility are in balance, but little scope for initiating change is expected or granted. Therefore, command capability is minimal.

Finally, the fourth quadrant in Figure 1 represents the potential for abuse of command, and is thus called dangerous command. It results when significant authority has been assigned or earned, but the individual has not been willing to accept responsibility for the proper use of this power. There have been many examples of

abuse of command in history,[33] and it is an outcome that most nations and their militaries try to avoid by invoking and enforcing judicial powers of punishment.

Yet abuse of authority is only one example of dangerous command. This quadrant also represents the potential outcome from automating command capability. As technology becomes more sophisticated and the need for greater speed and accuracy more pressing, 'empowering' automated systems to make very fast defen ive and offensive actions seems to be an attractive solution. However, two potentially negative outcomes for command are possible should this option be invoked. First, empowering automated systems pushes command into the dangerous command quadrant because such systems are incapable of accepting responsibility for their actions (i.e., they have the authority but not the responsibility). Second, since the human commander in this situation will still be expected to accept responsibility for the actions of automated systems (but now have less authority), they may find themselves situated in the ineffectual command quadrant. According to the CAR structure, militaries must carefully consider the repercussions of empowering automated systems.

Having discussed the four quadrants of the authority-responsibility surface, we are now in a position to reintegrate the competency dimension and to hypothesize the desired relationship among the three dimensions. Figure 2 illustrates three slices of the authority-responsibility surface for three different levels of competency (low, medium and high). The dot-filled ellipses located in each authority-responsibility surface represent the preferred command capability areas. When competency is low, as is usually the case for an entry level military member, the level of authority given to such a member should also be low, as should the expected level of responsibility. Too much authority and responsibility would overwhelm an individual who has not, as yet, attained the level of competency (physical, intellectual, emotional and interpersonal) necessary for the position. And from the organizational perspective, it is risky to assign authority to someone who does not have adequate competency to wield it. Conversely, if competency is high, too little authority and responsibility will induce boredom, low motivation and professional dissatisfaction.[34] Notice that the ellipses (i.e., the preferred command regions) in Figure 2 move diagonally across the authority-responsibility surface as competency increases. Also notice that regardless of the level of competency, the off-diagonals of the authority-responsibility surface should be avoided (i.e., dangerous command and ineffectual command). We assert, then, that the level of competency should match, or be well-balanced with, levels of authority and responsibility. A large imbalance in any one of the dimensions will lead to compromised command capability.

Finally, if the ellipses in Figure 2 are plotted successively for each increasing level of competency, a diagonal volume of space emerges that represents the ideal (or preferred) combination of competency, authority and responsibility.[35] This Balanced Command Envelope (BCE) is the region of the command capability space (see Figure 3) within which military organizations should ensure that all of their members lie throughout their careers. It is the region where competency, authority and responsibility are most in balance. It is the region that best protects militaries from dangerous or ineffectual command, and it is the region where motivation and initiative are maximized while the likelihood of poor performance and fear of failure are minimized. Although being (slightly) outside the BCE can sometimes have positive benefits — e.g., an acting position may motivate an individual to acquire greater levels of competency, thereby re-establishing the CAR balance — extreme outliers typically induce negative command conditions.[36]

In summary, we propose that command capability — i.e., the potential for creative expression of human will — is captured by the dimensions of competency, authority and responsibility. The command capability of all military members can be positioned within this three-dimensional space, and it behoves the military to ensure that its members stay on the BCE. Furthermore, the military should foster command potential in each of its members — through training and education to increase creativity and competency, through opportunities for exercising authority, and through challenging leadership to ensure motivation.

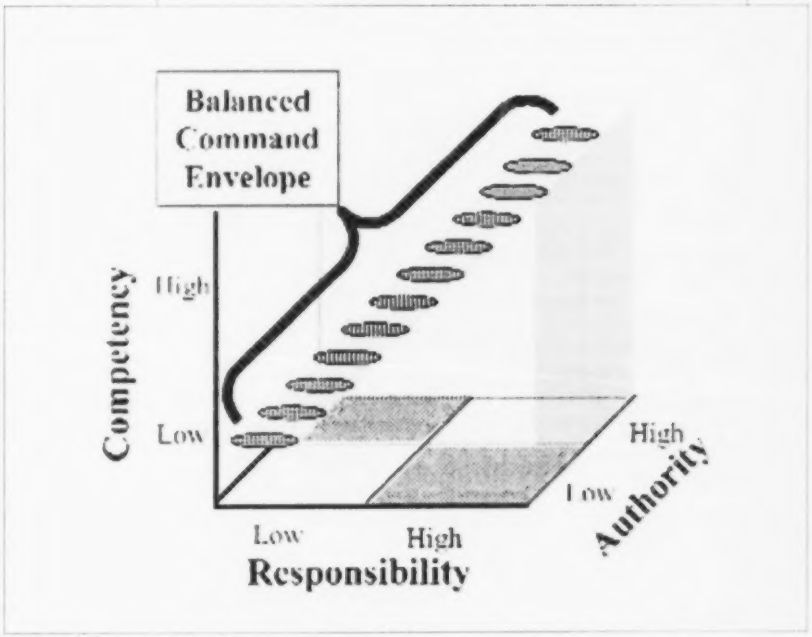

Figure 3 – The Balanced Command Envelope.

CONCLUSIONS

Our re-conceptualization of command and control is grounded first and foremost in new definitions. We believe that definitions are crucial: they provide the authoritative anchors for deriving new ideas, hypotheses and interpretations. We have attempted, in our definitions, to capture the essence of the concepts of command and control, giving them significance and precise meaning while encapsulating the nature and key qualities of each. In our view, the essence of control lies in structure and process, while the essence of command lies in creativity and will. Most importantly, however, our definition of command captures the fundamental assumption to which operational commanders have alluded to time and again — that humans bear the burden of command. So fundamental is this axiom that it seems to have suffered the fate of many axioms: its self-evident nature has concealed its significance. Our re-conceptualization gives this axiom the prominence and credit that it deserves.

Command and control are complementary. Command cannot be exercised without control, but control is meaningless without command. However, the two are not equal. Command creates and changes the structures and processes of control to suit the uncertain military situation, thus making command pre-eminent. Control should always be subordinate to command.

Only a few of the implications arising from our re-conceptualization of command and control have been discussed here. There are many more: for example, the difference between management and leadership, the nature of commandership, selection of appropriate control structures and processes to enable command, the function of technology, and the role of education in command development. We assert that our re-conceptualization, anchored in our definitions and extended through the CAR model, offers a coherent and powerful framework for advancing command and control theory and application.[57] Indeed, it may even provide a common vehicle for aligning command and control concepts among the three services.

Finally, the astute reader will have noticed that though command and control have been discussed extensively, C^2 has been neglected. It is an oddity of the military lexicon that C^2 means something different than command and control. Our new framework also includes a re-definition of the concept of C^2, but we must await a future opportunity to discuss it.

CMJ

NOTES

1. The term "command" has been used for at least the last 50 years in military writing. Prior to that, the concept of command was often subsumed under the concept of "generalship" (e.g., J.F.C. Fuller, 1936, *Generalship: Its Diseases and Cure. A Study of the Personal Factor in Command*, Harrisburg, PA: Military Service Publishing). The term "command and control" is of relatively recent vintage, appearing, we believe, coincident with the rise in information technology (IT) in the 1960s. Alan English, a Canadian military historian, points out that neither the term "command and control" nor, indeed, the term "control" was used in an address entitled "Higher Command in War" made by General Slim to the US Command and General Staff College on 8 Apr 1952 (reprinted in *Military Review*, Vol. 70, No. 5 (May 1990), pp. 10-21). In it, Slim speaks extensively about command, but though he talks about headquarters and their organizations, he doesn't use the word "control" at all. English takes this as good evidence that before IT, people considered command as the overarching activity, and that is was only with the advent of IT that the term C^2 appeared. (English, personal communication, 14 Nov 2001.)

2. These command and control philosophies are endorsed, respectively, by the Canadian Army ("Command," B-GL-300-033/FP-000 Land Force, Volume 3), the Canadian Air Force ("Out of the Sun – Aerospace Doctrine for the Canadian Forces," B-GA-400-000/AF-000) and the US Navy (see P. Forgues "Command in a Network-Centric War," 2001, Canadian Military Journal, Vol. 2, No. 2, pp. 23-30 for a discussion of the network-centric approach to C^2 and its adoption by the U.S. Navy).

3. The complexities of command authorities and relationships within the NATO Alliance are discussed by Thomas-Durell Young in *Multinational Land Operations and NATO Reforming Practices and Structures* (Strategic Studies Institute, U.S. Army War College, Carlisle Barracks, PA, 1997).

4. NATO "Glossary of Terms and Definitions" (STANAG AAP-6(R), 1988). See C. McCann and R. Pigeau "Taking Command of C^{2n}" (Proceedings of Second International Command and Control Research & Technology Symposium, 1995, Washington, DC: Institute for National Strategic Studies, pp. 531-545) for a more detailed description of the problem of using the NATO definitions as a basis for a consistent conceptual framework for C^2.

5. Foster, G. D. (1988), "Contemporary C^2 theory and research: The failed quest for a philosophy of command," *Defense Analysis*, 4(3), p. 213.

6. The largest scientific conferences on C^2 are the Command and Control Research and Technology Symposia (CCRTS) held under the auspices of the Center for Advanced Concepts and Technology at the National Defense University in Washington, DC. A US-based CCRTS, with about 120 papers, is held in June each year. An international CCRTS is held biannually in a country other than the US, with the next one planned for Quebec City in September, 2002. These meetings have addressed mainly technologies for C^2. Recently, a new series of conferences has been initiated, focussing exclusively on command. The first of these "Human in Command" meetings was held in 1998 at Ft. Frontenac, Kingston with the proceedings subsequently published in a book of the same title, edited by C. McCann and R. Pigeau (London: Kluwer/Academic, 2000). A second Human in Command conference was held in Breda, NL in June 2000.

7. The framework has been presented in a variety of military fora over the last five years, including the DLSC-sponsored Army Futures meetings; the Maritime Warfare Command and Staff Course at MWC; and both the Advanced Military Studies Course and the Command and Staff Course at the Canadian Forces College; as well as to war studies students in the Dept. of Military Leadership and Psychology at RMC. In February of this year it was briefed at a DCDS Strategic Retreat and, in addition, to the Naval Board. Also during its development, the framework has been regularly presented at both the CCRTS (see footnote 6) and the Human in Command meetings.

8. See N. Weiner, *Cybernetics* (1961, Cambridge, MA: MIT Press) for a fuller treatment. A special type of cybernetic control is called Perceptual Control Theory (*Behaviour – The Control of Perception*, W.T. Powers, 1973, Chicago: Aldyne) where a psychological perception, rather than an outcome, is compared to a goal. Regardless, both types are regulated via feedback mechanisms, which may occur in a cycle repeatedly until the goal is achieved.

9. NATO *Glossary of Terms and Definitions* (STANAG AAP-6(R), 1988).

10. W.R. Garner, *Uncertainty and Structure as Psychological Concepts* (1962, New York: John Wiley and Sons).

11. Control structures and processes differ in their degree of formality and rigidity, ranging from the high rigidity of equipment and software; through plans and rules of engagement; to organizational structure and doctrine, the latter having somewhat more flexibility. See R.

Pigeau and C. McCann "Putting 'Command' back into Command and Control: The Human Perspective" (Proceedings of Command and Control Conference, 1995, Ottawa: Canadian Defence Preparedness Association) for a more extensive description of control structure and process within C^2.

12. A well-known definition of creativity is that given by D.W. MacKinnon ("The Nature and Nurture of Creative Talent," 1962, *American Psychologist*, 17, pp. 484-495): "A process extended in time and characterized by originality, adaptiveness and realization." According to this definition, for an action or idea to be creative, it must address a problem (i.e., be adaptive) as well as be novel. Furthermore, the process of creativity must entail the full development of an original idea (i.e., its realization). Subsequent conceptualizations of creativity have also stressed the importance of intentionality and personal identity in creative behaviour (R.S. Albert, "Identity, Experiences and Career Choice among the Exceptionally Gifted and Talented," 1990, In M.A. Runco and R.S. Albert (Eds.), *Theories of Creativity*, Newbury Park, CA: Sage, pp. 13-34).

13. For a review of theories, models and research on creative behaviour and the assessment of creativity, see J.R. Feldhusen and B.E. Goh ("Assessing and Accessing Creativity: An Integrative Review of Theory, Research, and Development," 1995, *Creativity Research Journal*, Vol. 8, No. 3, pp. 231-247). These authors place creative problem solving in the realm of cognition, but they acknowledge the critical influence of personality factors, motivation and cognitive style, as well as the flexibility and openness of the environment on creative behaviour. For a more extensive treatment of the subject in which the many research perspectives on creativity are explored, the reader is referred to the *Encyclopedia of Creativity* (M.A. Runco and S.R. Pritzker (Eds.) 1999, New York: Academic Press).

14. Control makes assumptions about typicality in military situations: typical resources needed, typical environments encountered, typical adversaries fought. The more complex a control system is (e.g., an air defence or weapons system), the greater the number of assumptions that are embedded in its design. The degree to which an available control system is suitable for a particular operation is a function of the degree to which its structure and process, as well as the assumptions underlying those structures and processes, match the military situation. The match, of course, has never been and will never be exact, but we can expect that as the range of military operations broadens, the probability of pre-existing control matching the situation will be much lower.

15. Van Creveld asserts that "in armed conflict no success is possible – or even conceivable – which is not grounded in an ability to tolerate uncertainty, cope with it and make use of it." (*Technology in War*, 1989, New York: The Free Press, p. 316.)

16. S.L.A. Marshall suggested that "60 percent of the art of command is the ability to anticipate; 40 percent is the ability to improvise, to reject the preconceived idea that has been tested and proved wrong in the crucible of operations and to rule by action instead of acting by rules." (*Men under Fire*, 1947, p. 108.)

17. For example, Montgomery viewed command as "the capacity and the will to rally men and women to a common purpose and the character which inspires confidence." (Field Marshall Viscount Montgomery of Alamein, *Memoirs*, 1958, London: Collins, p. 80.)

18. R. Crabbe, "The Nature of Command," 2000, in C. McCann & R. Pigeau (Eds.), *The Human in Command*, New York: Kluwer Academic/Plenum, pp. 9-16.

19. There is a huge literature on the scientific study of motivation. For a comprehensive review of the research, see R.C. Beck, *Motivation: Theories and Principles* (Fourth Edition, 2000, Upper Saddle River, NJ: Prentice Hall).

20. These structures and processes standardize the relatively well-defined activity of manufacturing cars, making it efficient.

21. On the other hand, human command can develop novel (and often simple) approaches to undermine sophisticated control systems, the so-called 'asymmetric threat'. Despite the tragedy and immorality of the terrorist actions of 11 September 2001, they were perfect examples of the creative expression of human will.

22. The Operational Planning Process (OPP) offers a procedure to assist in making decisions about a military course of action. However, there are many points in the OPP where human creativity is required – for example, the human must initiate the planning process, must devise candidate courses of action, and must determine criteria on which they will be assessed.

23. The difference between command and commandership is addressed in R. Pigeau and C. McCann, "What is a Commander?" in B. Horn & S. Harris (Eds.), *Generalship and the Art of the Admiral*, St. Catherines, ON: Vanwell Press, pp. 79-104).

24. M. van Creveld, *Command in War* (1985, Cambridge, MA: Harvard University Press, p. 255).

25. M.M. Thompson & M.A.M. Gignac "Adaptation to Peace Support Operations: The Experience of Canadian Forces Augmentees" (P.J.M.D. Essens, A.L.W. Vogelaar, E. Tanercan, and D.J. Winslow (Eds.) 2001, *The Human in Command: Peace Support Operations*, Amsterdam: Mets & Schilt).

26. A special issue of *Consulting Psychology Journal* (Vol. 51, No. 2, Spring, 1999) addresses the recent research on hardiness. See in particular the article by P.T. Bartone on "Hardiness Protects against War-related Stress in Army Reserve Forces" (pp. 72-82).

27. The National Defence Act and the Queen's Regulations and Orders are the two principle sources of legal authority for the Canadian Forces.

28. Quoted in J.F. Schnabel, "Ridgway in Korea," *Military Review*, March 1964, p. 9.

29. B.P. Turner's historical account of Simon Bolivar given in "Military Leadership and Command: The John Biggs Cincinnati Lectures, 1988" (H.S. Bausum (Ed.), 1989, Lexington VA: The VMI Foundation, Inc) provides a good example of the power of personal authority. Bolivar was able to bring disparate groups in South America together in revolution against Spain and to "forge national will out of ill-defined discontent".

30. See B.R. Schlenker, T.W. Britt, J. Pennington, R. Murphy and K. Doherty, "The Triangle Model of Responsibility" (1994, *Psychological Bulletin*, Vol. 101, No. 4, pp. 632-652) for a recent conceptualization of responsibility in terms of social judgment.

31. The concept of accountability is explored in D.D. Frink and R.J. Klimoski "Toward a Theory of Accountability in Organizations and Human Resources Management" (1998, *Research in Personnel and Human Resources Management*, Volume 16, JAI Press, pp. 1-51).

32. R.A. Dallaire, "Command Experiences in Rwanda." In C. McCann & R. Pigeau (Eds.), 2000, *The Human in Command*, New York: Kluwer Academic/Plenum, pp. 29-50.

33. e.g., Hitler, Eichmann, My Lai; see also N. Dixon, *On the Psychology of Military Incompetence*, 1976, London: Random House.

34. The following observation by Col Mike Capstick is relevant here: "Today's soldiers are older and better educated than their Second World War counterparts. Most are married, have children and are more than capable of making their own decisions; they therefore expect and demand that their experience, expertise, and professionalism be respected." ("Command and Leadership in Other People's Wars," 2000, in C. McCann & R. Pigeau (Eds.), *The Human in Command*, New York: Kluwer Academic/Plenum, p. 89.) If the CF does not match this increased competency with increased authority, it may lose these soldiers.

35. The exact nature of this relationship (e.g., linear, curvilinear, etc.) is an empirical question.

36. For examples of the implications of lying outside the BCE, see C. McCann & R. Pigeau, "Clarifying the Concepts of Control and of Command," 1999, Proceedings of the Command and Control Research and Technology Symposium, Washington, DC: CCRP, Dept. of Defense, pp. 475-490.

37. The framework is the conceptual umbrella for the new Defence R&D Canada research program in Command Effectiveness and Behaviour. It has provided a structure for discussing command in TTCP/TP11, an international collaborative research group on Military Command involving Canada, the U.K., the U.S. and Australia. Recently, it has also been adopted by several students at CFC as a basis for their analyses of military command, both current and historical.

DND Photo IND 01-357A

More than 700 reservists from Ontario participated in an urban combat exercise in Fort Benning, Georgia, in March 2001.